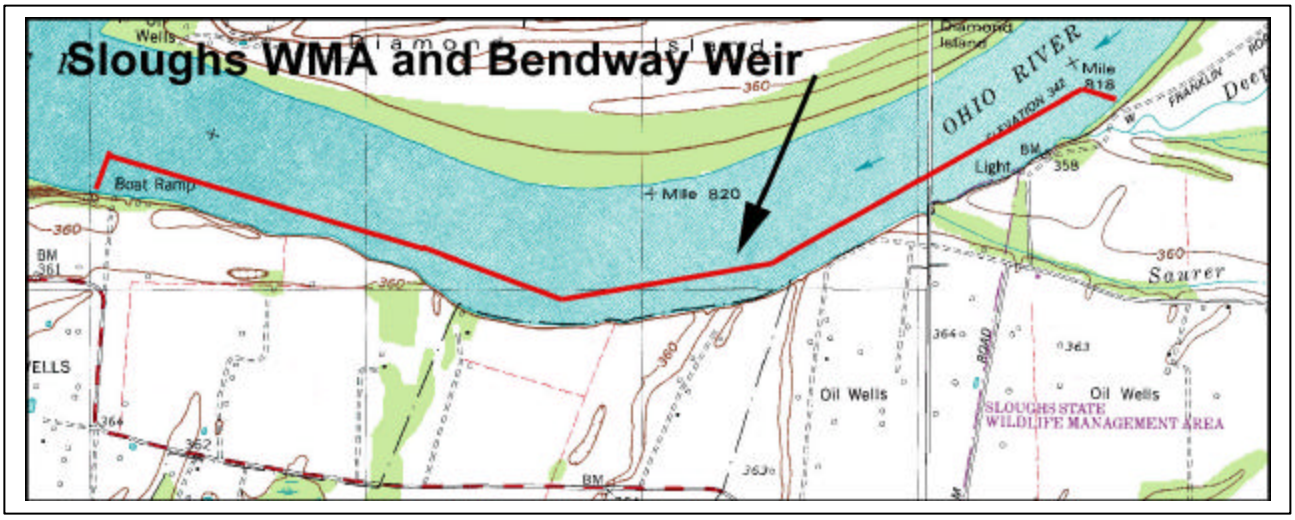
Sloughs WMA Habitat Protection and Bendway Weir (KY-18)

1.0 Location

The proposed Sloughs Wildlife Management Area (WMA) Habitat Protection and Bendway Weir project area is located in Henderson County, Kentucky. The project area is located along the south bank of the Ohio River, approximately 5 miles north of the town of Smith Mills, Kentucky. The project area is located between Ohio River miles 818-821. The project site is within the Louisville District, U.S. Army Corps of Engineers (USACE).



2.0 Project Goal, Description, and Rationale

The primary goals of the Sloughs WMA Habitat Protection and Bendway Weir project involve the protection of public property, preservation of existing waterfowl habitat, and improvement of aquatic habitat in the Ohio River. Severe erosion along the riverbank of the Ohio River has caused property loss, habitat loss and degradation, and increased sediment loads entering the Ohio River.

3.0 Existing Conditions

Terrestrial/Riparian Habitat: The terrestrial and riparian habitat is limited in the project area. The floodplain terrace is primarily used as agricultural land. The riparian corridor is almost non-existent due to the rapid erosion taking place along the banks of the Ohio River. Existing stands of timber in the project area are dominated by species such as silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*).

Aquatic Habitats: The project area is located along a rapidly eroding bank of the Ohio River. There is a moderate current present in the river and a steep drop off into deeper water. The location of the main channel is such that barges pass extremely close to the river bank in this area.

Wetlands: There are no jurisdictional wetlands present in the project area.

Federally-Listed Threatened and Endangered Species: According to the U.S. Fish and Wildlife Service (USFWS), there are 11 federally-listed endangered species and 1 federally-listed threatened species known to occur in Henderson County, Kentucky. These species are listed on Table 1.

The riparian corridor adjacent to the Ohio River may provide summer roost habitat for the Indiana bat. Preferred tree species would include a mixture of oaks (*Quercus* spp.), silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), and shagbark hickory (*Carya ovata*) (INHS, 1996). The riparian corridor would also provide feeding/foraging habitat for the Indiana bat.

Bald eagles and peregrine falcons may utilize forested areas for roosting/perching habitat and feed in the open water areas. There are no known eagle nests in the project area.

All of the mussels are freshwater species that typically inhabit medium to large river systems. The mussels are typically found in habitats with substrates that range from silt to gravel, and in water depths from 0.5 to 8.0 meters. These species are generally associated with moderate to fast flowing water. There does not appear to be suitable habitat for these species in the immediate vicinity of the project area.

The American burying beetle is generally associated with upland habitats such as grassland prairie, forest edge, and shrubland. Due to the ongoing intensive agriculture, the use of pesticides, and the fact that the entire project area is in the floodplain, it is unlikely that the beetle would be found on the project area.

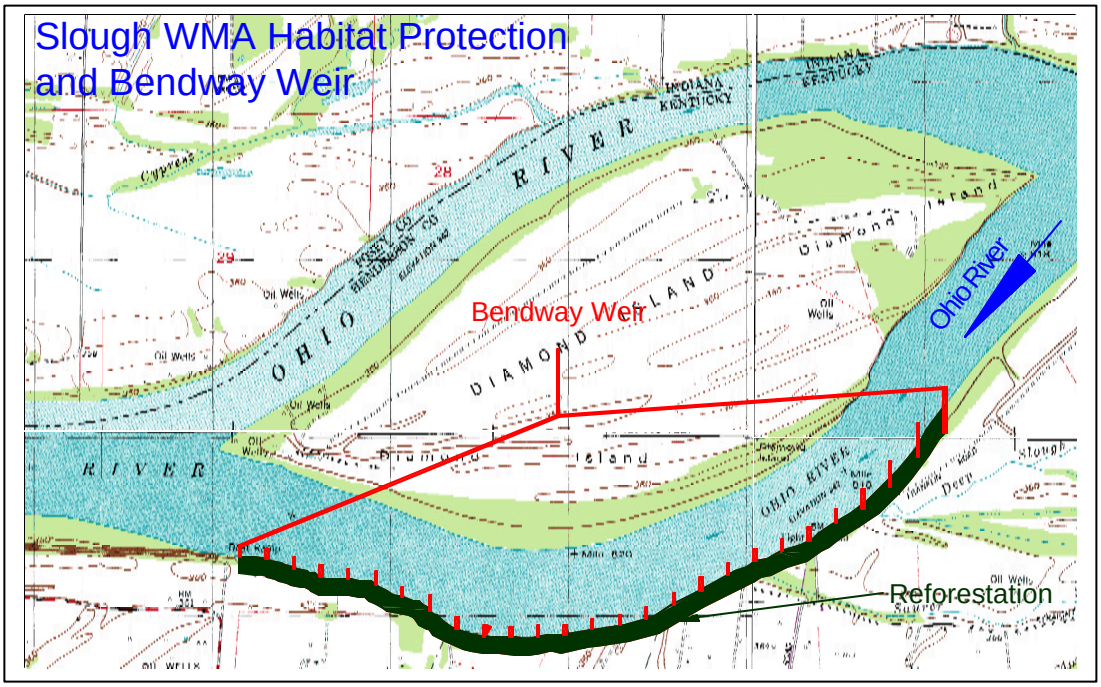
According to the USFWS, it is believed that the eastern cougar has been extirpated from Kentucky. Much of the cougar's habitat has been eliminated through deforestation and development. The primary habitat needs for the cougar are large wilderness areas and adequate food sources. Due to lack of suitable habitat, it is highly unlikely that this species exists near the project area.

Table 1. Federally-listed species known to occur in Henderson County, Kentucky.

Common Name	Scientific Name	Federal Status	Potential Habitat Present
eastern cougar	*Felis concolor couguar*	Endangered	No
Indiana bat	*Myotis sodalis*	Endangered	Yes
bald eagle	*Haliaeetus leucocephalis*	Threatened	Yes
peregrine falcon	*Falco peregrinus*	Endangered	Yes
eastern fanshell pearly mussel	*Cyprogenia stegaria*	Endangered	No
tubercled blossom mussel	*Epioblasma torulosa torulosa*	Endangered	No
pink mucket pearly mussel	*Lampsilis abrupta*	Endangered	No
ring pink mussel	*Obovaria retusa*	Endangered	No
white wartyback mussel	*Plethobasus cicatricosus*	Endangered	No
purple cat's paw pearly mussel	*Epioblasma obliquata obliquata*	Endangered	No
fat pocketbook mussel	*Potamilus capax*	Endangered	No
American burying beetle	*Nicrophorus americanus*	Endangered	No

Source: U.S. Fish and Wildlife Service, 1999

4.0 Project Diagram

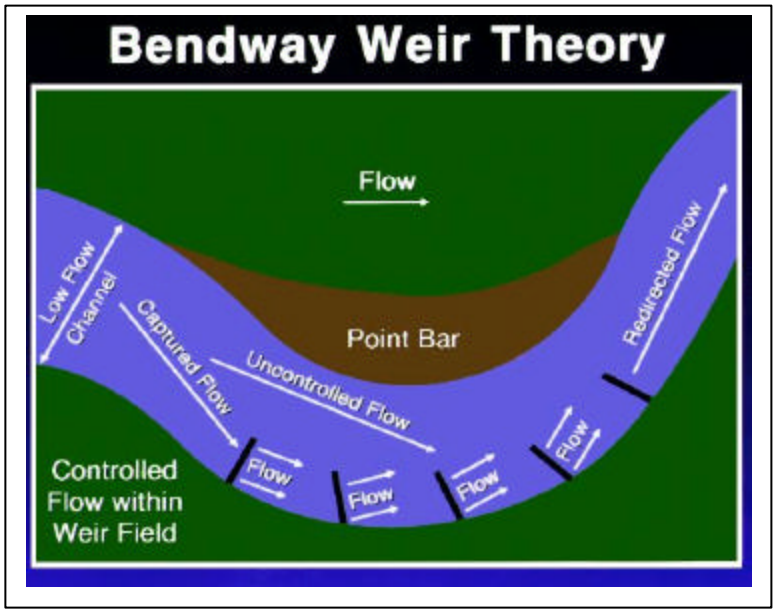


5.0 Engineering Design, Assumptions, and Requirements

5.1 Existing Ecological/Engineering Concern

The bank along the Ohio River is eroding at a rapid rate, which is resulting in the loss of public property and increased inputs of sediment into the Ohio River.

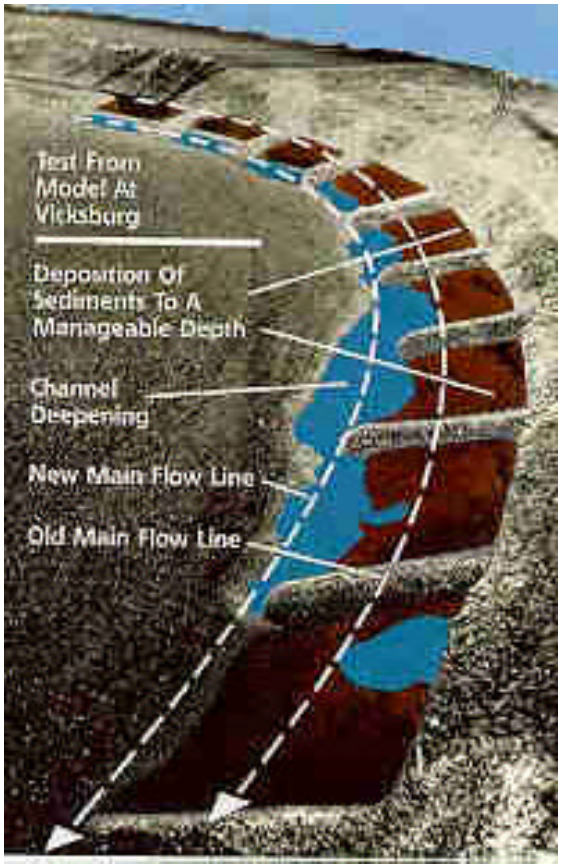
5.2 Bendway Weirs



A Bendway Weir is a rock sill located in the navigation channel of a bend, usually angled 20 to 30 degrees upstream, low enough to allow normal river traffic to pass over unimpeded. They are designed to act as a system to control velocities and current directions through the bend. Bendway weirs would be constructed at 500-foot intervals along the 12,800-foot long outside bend. A total of 26 weirs would be used to stabilize the eroding bank at Sloughs WMA. Each revetment would be 200 feet in length, would stand 12 feet above the bottom of the Ohio River bed. The side slopes would be 1.5 to 1, and the structure would be toed into the sub-grade a minimum of 2 feet.

Benefits of the Bendway Weirs

- Redirect the current away form the eroding bank.
- Deposition at the toe of the revetment on the outside of the bend (increasing bank stability).
- Scouring occurs on the point bar creating a flow path on the inside of the bend.
- Surface water velocities would be more uniform at any section through the bend.
- The thalweg of the channel is moved from the toe of the outer bank revetment to the river ends of the weirs.
- Aquatic Habitat is improved.



5.3 Reforestation

Reforestation of the riparian corridor would also aid in bank stabilization activities. A riparian corridor 300 feet in width and 12,800 feet in length would be reforested along the Ohio River shoreline. Approximately 90 acres would be reforested on Sloughs WMA.

Soil types, hydrology, and terrain position would be the primary factors considered when selecting the tree species to be planted, and a detailed planting design should be developed in order to insure that the planting effort is successful. Typical bottomland species to be planted in the floodplain area would include pin oak (*Quercus palustris*), swamp chestnut oak (*Quercus michauxii*), swamp white oak (*Quercus bicolor*), pecan (*Carya illinoensis*), and shagbark hickory (*Carya ovata*). Aggressive light mast producing species, such as silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), and/or willows (*Salix* spp), would be expected to regenerate naturally.

5.4 Planning/Engineering Assumptions

Before final design of the Bendway Weirs, a careful assessment of the existing bend condition, geometry, planform, stages and discharges, sediment transport capacity, and stream features must be undertaken. The current directions and velocities entering the area of the proposed weir field must be carefully measured and analyzed. Weirs should be designed for low, medium, and high flow conditions, with more weight allocated to the higher energy, medium to high flow conditions.

6.0 Cost Estimate (Construction)

Table 2. Project Cost	
Item	**Cost**
Management Plan	$5,000
Bendway Weirs	$2,776,500
Reforestation (88 acres)	$19,300
Mobilization	$150,000
TOTAL	**$2,950,800**

7.0 Schedule

Table 3. Project Schedule	
Item	**Time**
Management Plan	15 Days
Bank Stabilization (12,800 feet)	150 Days
Reforestation (88 acres)	60 Days
Mobilization	10 Days
TOTAL	**235 Days**

8.0 Expected Ecological Benefits

Terrestrial/Riparian Habitats: Potential long-term benefits for terrestrial and riparian resources would be anticipated as a result of implementing the proposed project. Control of shoreline erosion and restoration of riparian vegetation would benefit many wildlife species. Travel corridors for terrestrial wildlife and habitat for neotropical migrants would be provided by reforestation of the riparian zone.

Aquatic Habitats: Control of shoreline erosion would benefit aquatic resources in the area by reducing the amount of sediments that enter the water column. Reduced erosion would benefit sensitive fish, mussel, and invertebrate communities near the project area. The Bendway weirs would provide habitat structure for riverine fishes and also provide hard substrate for aquatic invertebrate colonization.

Wetlands: There would be no foreseeable beneficial impacts to jurisdictional wetlands as a result of implementing the proposed project.

Federally-Listed Threatened and Endangered Species: Restoration of the riparian zone would potentially benefit endangered Indiana bats by providing foraging habitat on the project area. Future summer roosting habitat for Indiana bats could be provided by exfoliating bark or tree cavities if reforestation of the riparian zone is successful.

Control of bank erosion would reduce sedimentation inputs into the river and potentially reduce impacts to endangered mussel species downstream of the project area. Increased diversity of aquatic habitats may also improve habitat for endangered mussel species.

Socioeconomic Resources: Socioeconomic resources would benefit from the implementation of the proposed project. Bank stabilization would protect public property from further losses through shoreline erosion.

9.0 Potential Adverse Environmental Impacts

Terrestrial/Riparian Habitats: There would be no reasonably foreseeable adverse impacts to terrestrial or riparian resources as a result of implementing the proposed project.

Aquatic Habitats: There would be no reasonably foreseeable adverse impacts to aquatic resources as a result of implementing the proposed project.

Wetlands: There would be no reasonably foreseeable adverse impacts to jurisdictional wetlands as a result of implementing the proposed project.

Federally-Listed Threatened and Endangered Species: There would be no reasonable foreseeable adverse impacts to federally-listed threatened or endangered species as a result of implementing the proposed project.

Socioeconomic Resources: There would be no reasonably foreseeable adverse impacts to socioeconomic resources as a result of implementing the proposed project.

10.0 Mitigation

Minor impacts associated with bank stabilization may occur during the construction of this project, however, no significant adverse impacts are expected. The use of best management practices and proper construction techniques would minimize adverse water quality impacts.

11.0 Preliminary Operation and Maintenance Costs:

Table 4. Operation and Maintenance Costs

Maintenance	Frequency	Costs
Repair of Rock Structures	10 years	$60,000

12.0 Potential Cost Share Sponsor(s)

- Kentucky Department of Fish and Wildlife Resources
- Ducks Unlimited
- Navigation industry

13.0 Expected Life of the Project

It is anticipated that the bank stabilization project would prevent shoreline erosion and protect habitat for a minimum of 50 years before further work would be necessary.

14.0 Hazardous, Toxic, and Radiological Waste Considerations

Potential impacts of hazardous, toxic, and radiological waste (HTRW) at the site were visually assessed during a site visit.

Site Inspection Findings.

The project areas consist of portions of Sloughs Wildlife Management Area (Sauerheber Unit) on the south bank of the Ohio River in Henderson County, Kentucky and areas within the Ohio River. Diamond Island is a very large island in the Ohio River just offshore (north) of Sloughs WMA. The project areas along the Ohio River shoreline at Sloughs WMA and the Bendway Weir project are located between Ohio River mile 818 and 821. There are no towns within a mile of the project area on the Kentucky side of the river. The town of West Franklin, Indiana is located on the north bank of the Ohio River near river mile 818.

The following environmental conditions were considered when conducting the July 15, 1999 project area inspection:

- Suspicious/Unusual Odors;
- Discolored Soil;
- Distressed Vegetation;
- Dirt/Debris Mounds;
- Ground Depressions;
- Oil Staining;
- Above Ground Storage Tanks (ASTs);
- Underground Storage Tanks (USTs);
- Landfills/Wastepiles;
- Impoundments/Lagoons;
- Drum/Container Storage;
- Electrical Transformers;
- Standpipes/Vent pipes;
- Surface Water Discharges;
- Power or Pipelines;
- Mining/Logging; and
- Other.

Agricultural lands are located in the project area. Severe erosion along the south bank of the Ohio River has resulted in a few buildings (barns) falling into the river.

HTRW Findings and Conclusions

None of the environmental conditions listed above were observed in the project area.

15.0 Property Ownership

Table 5. Property Characteristics

Site Name: Sloughs WMA Habitat Protection and Bendway Weir
Location: Henderson County, Kentucky

Map/Parcel Number	Owner	Mailing Address	Market Value	Acreage
16/1	Kentucky Department of Fish & Wildlife	(not listed)	$565,600	452.48
16/2	Kentucky Department of Fish & Wildlife		$450,000	430.00
16/3	Kentucky Department of Fish & Wildlife		$52,960	103.28
16/4	Kentucky Department of Fish & Wildlife		$150,753	131.09

* Denotes improvements on property.

16.0 References

INHS, 1996	Illinois Natural History Survey Reports, March-April 1996. Survey Document #2152. Center for Biodiversity (J. Hofmann).
USACE-WES, 1999	U.S. Army Corps of Engineers Waterways Experiment Station Internet Web Page
USACE-St. Louis District, 1999	U.S. Army Corps of Engineers St. Louis District Internet Web page
USFWS, 1983	U.S. Fish and Wildlife Service, 1983. Northern States Bald Eagle Recovery Plan. USFWS Denver, Colorado
USFWS, 1983	U.S. Fish and Wildlife Service, 1983. Recovery Plan for the Indiana bat (*Myotis sodalis*).
USFWS, 1985	U.S. Fish and Wildlife Service, 1985. Recovery Plan for the Tuberculed-blossom Pearly Mussel, *Epioblasma torulosa torulosa*, Turgid-blossom Pearly Mussel, *Epioblasma turgidula*, Yellow-blossom Pearly Mussel, *Epioblama florentina florentina*. USFWS Atlanta, Georgia. 42pp.
USFWS, 1985	U.S. Fish and Wildlife Service, 1996. Recovery plan for the pink mucket pearly mussel. USFWS Atlanta, Georgia.
USFWS, 1991	U.S. Fish and Wildlife Service, 1991. Recovery Plan for Ring Pink Mussel (*Obovaria retusa*). Prepared by R.G. Biggins for the Southeast Region USFWS February, 1991. 24pp.
USFWS, 1999	U.S. Fish and Wildlife Service, 1999. Federally endangered, threatened, and proposed species, Kentucky.

APPENDIX A Threatened & Endangered Species

APPENDIX B Plan Formulation and Incremental Analysis Checklist

Project Site Location: The proposed Sloughs Wildlife Management Area (WMA) Habitat Protection and Bendway Weir project area is located in Henderson County, Kentucky. The project area is located along the south bank of the Ohio River, approximately 5 miles north of the town of Smith Mills, Kentucky. The project area is located between Ohio River miles 818-821. The project site is within the Louisville District, U.S. Army Corps of Engineers (USACE).

Description of Plan selected: The primary goals of the Sloughs WMA Habitat Protection and Bendway Weir project involve the protection of public property, preservation of existing waterfowl habitat, and improvement of aquatic habitat in the Ohio River. Severe erosion along the riverbank of the Ohio River has caused property loss, habitat loss and degradation, and increased sediment loads entering the Ohio River.

Alternatives of the Selected Plan:

Smaller Size Plans Possible? Yes Reduce the amount of bank stabilization efforts.

Larger Size Plan Possible? Yes Increase the amount of bank stabilization efforts.

Other alternatives? No

Restore/Enhance/Protect Terrestrial Habitats? Yes **Objective numbers met** T1,T3

Restore, Enhance, & Protect Wetlands? No **Objective numbers met**

Restore/Enhance/Protect Aquatic Habitats? Yes **Objective numbers met** A8

Type species benefited: Riverine fishes

Endangered species benefited: Indiana bat and endangered mussel species

Can estimated amount of habitat units be determined: 12,800 feet of shoreline would be protected and 88 acres of riparian habitat would be reforested.

Plan acceptable to Resources Agencies?

U.S. Fish & Wildlife Service?

State Department of Natural Resources? Kentucky Dept. of Fish and Wildlife Resources

Plan considered complete? Yes **Connected to other plans for restoration?** No

Real Estate owned by State Agency? Yes **Federal Agency?** No
Real Estate privately owned? No
If privately owned, what is status of future acquisition No acquisition required

Does this plan contribute significantly to the ecosystem structure or function requiring restoration? What goal or values does it meet in the Ecosystem Restoration Plan?

Yes This project would protect shoreline habitat and increase the amount of forested riparian corridor.

Is this restoration plan a part of restoration projects planned by other agencies? (i.e. North American Waterfowl Management Plan, etc.)

Unknown

In agencies opinion is the plan the most cost effective plan that can be implemented at this location?

Can this plan be implemented more cost effectively by another agency or institution?
Yes / No
Who:

From an incremental cost basis are there any features in this plan that would make the project more expensive than a typical project of the same nature? For embayment type plans is there excessive haul distance to disposal site? More expensive type disposal? Spoil that requires special handling/disposal?

Potential Project Sponsor:

Government Entity:_____
Non-government Entity _____

Corps Contractor _____Date_____

U.S. Fish & Wildlife Representative _____Date_____

State Agency Representative _____Date _____

U.S. Army Corps of Engineers Representative _____Date _____

Terrestrial Habitat Objectives

T1 Riparian Corridors

T2 Islands

T3 Floodplains

T4 Other unique habitats (canebrakes, river bluffs, etc.)

Wetland Habitat Objectives

W1 Forested Wetlands: Bottomland Hardwoods

W2 Forested Wetlands: Cypress/Tupelo Swamps and other unique forested wetlands

W3 Scrub/Shrub Emergent Wetlands: isolated from the river except during high water and contiguous (includes scrub/shrub wetlands in embayments and island sloughs)

Aquatic Habitat Objectives

A1 Backwaters (sloughs, embayments, oxbows, bayous, etc.)

A2 Riverine submerged and aquatic vegetation

A3 Sand and gravel bars

A4 Riffles/Runs (tailwaters)

A5 Pools (deep water, slow velocity, soft substrate)

A6 Side Channel/Back Channel Habitat

A7 Fish Passage

A8 Riparian Enhancement/Protection

APPENDIX C Micro Computer-Aided Cost Engineering System (MCACES)